OSCAR-LOWeFLOW™ Treatment System Design Manual
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Manufactured by:

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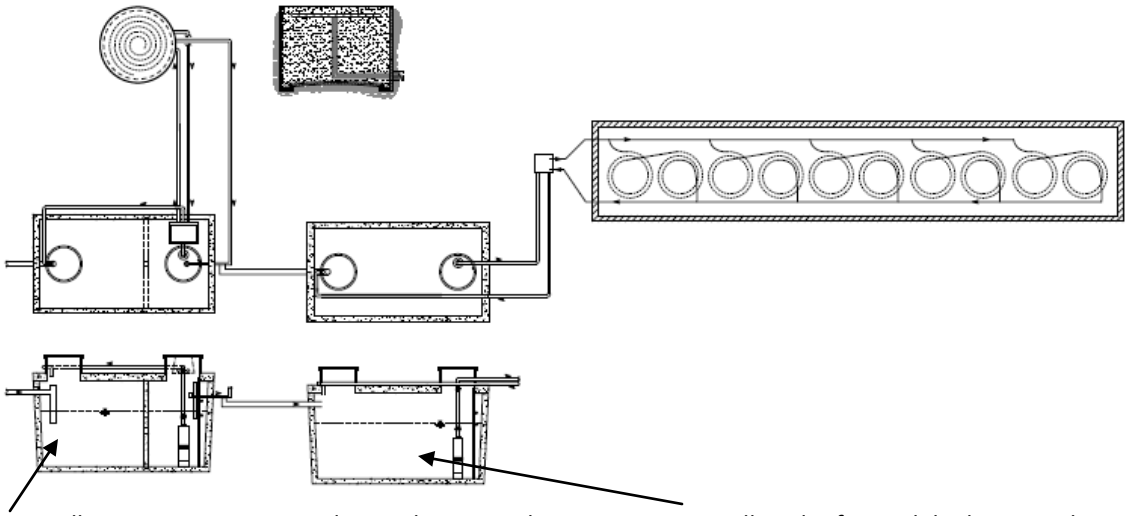
OSCAR-LOWeFLOW™: LFOS-480



1500 gallon 2 compartment settling and recirc tank

1000 gallon clarifier and discharge tank

Preface:

This manual is written in two sections: first the *OSCAR* design and then the *LOWeFLOW™* section. Even though there are two sections, the *OSCAR-LOWeFLOW™* system is considered one complete treatment and dispersal system. The single family residence packages are designated as: *LFOS-240, LFOS-360, LFOS-480,* and *LFOS*-600 and have the corresponding design flows of 240, 360, 480, and 600 gallons per day. The *LFOS-240, 360, and 480* include an *LF-500* treatment unit (500 gpd) with the corresponding number of *OSCAR* coils. The *LFOS-600* includes a *LF-600* treatment unit and the corresponding number of *OSCAR* coils.

The *LOWeFLOW*™ unit has 8 standard design flow rates: 500, 600, 1000, 1500, 2000, 2500, 3000, and 3500 gallons per day. The *OSCAR* units can be designed in increments of 50 gallons per coil per day. Consequently, an *OSCAR-LOWeFLOW™* system could be designed for 850 gpd: an *LF-1000* with 17 *OSCAR* coils (17 x 50 gallons = 850 gallons per day).

The *LFOS-240, 360, 480, & 600* are standard packages. All other design flows greater than 600 gallons per day are considered custom and will require design assistance from *Lowridge Onsite Technologies, LLC.*

Intro:

The ***OSCAR*** (**O**nsite **S**and **C**oil **A**rea **R**echarge) is an onsite sewage dispersal component for use with the *LOWeFLOW* treatment unit. The *OSCAR* is comprised of a 6" layer of C-33 sand media and a series of Netafim Bioline drip tubing coils. The sand media is placed on a prepared soil surface. *OSCAR* coils are then placed on the sand media and then are covered with another 6" of sand media. No other cover material is needed. To control erosion, spread straw over final cover until vegetative cover takes

hold: plant grass seed or other ground cover as soon as possible. The sand/soil interface is the discharge point of the treated wastewater. Vertical separation is measured from the original soil surface prior to preparation and the restrictive layer. If enough soil depth is present, the basal area can be excavated to lower the profile of the *OSCAR* and/or to modify the slope of the infiltrative area. The *OSCAR-LOWeFLOW™* system meets treatment level "B" (15 mg/l CBOD5, 15 mg/l TSS, and 1,000 FC/100 ml MPN), without UV disinfection.

Design:

Each ***OSCAR*** coil is designed to treat and dispose of 50 gpd of *LOWeFLOW™* effluent. For design flows of 500 gpd or less the *OSCAR* must be preceded by a *LF-500 LOWeFLOW™* treatment unit. For design flows greater than 500 gpd the *LOWeFLOW™* treatment unit must be sized in accord with the design flow. Minimum vertical separation depth is 12", except in soil type 1 where a minimum of 18" of vertical separation will be required. There is no stacking of OSCAR coils down gradient.

An OSCAR has two (2) sizing criteria: *hydraulic* and *basal* area. The hydraulic criterion includes the number of coils and how they are to be connected. The basal area refers to the overall foot print of the *OSCAR* sand/soil interface.

Hydraulic: Coils are arranged in laterals. Each lateral is a single coil or a group of coils linked in series between the supply and flush manifolds. Coils will be arranged in a single line along the contour. The *OSCAR* coils are timed dosed and flushed, manually, every six months.

The standard single family residence *OSCAR* packages with design flows between 240 to 600 gpd include a 19 gpm, 110 volt, turbine pump and a LOT-HWN-.7 headworks for dosing the *OSCAR* coils. This pump will perform in a large majority of design applications. Table XY depicts the number of coils and laterals required for a given design flow using this pump. The table will also indicate how much excess head is available for supply line elevation lift and friction loss. All manifolds, supply and flush lines are 1" sch 40 PVC. The designer must calculate the total dynamic head (TDH) for the supply line. Use the flow rate indicated under the heading "Flush GPM" in Table XY for the corresponding design flow to calculate the friction loss of the supply line. If the calculated TDH is greater than the "Excess TDH" value in Table XY, call Lowridge for assistance. TDH is calculated by adding the friction loss of the supply line to the elevation lift from liquid level in pump tank to the *OSCAR* coils. Use the following Hazen-Williams formula to calculate friction loss.

$$f = L\,(Q/K)^{1.85}$$

F= friction loss through pipe in feet of head
L= length of supply line in feet
Q= Flush GPM
K=47.8 (1" sch 40 PVC pipe)

TABLE XY

Design flow	Total coils	# of lats.	Coils per lat.	Dose GPM	Flush GPM	Excess TDH
240	5	5	1	1.75	9.75	105'
360	8	4	2	2.8	9.2	105'
480*	10	2	5	3.5	6.7	70 '
480*	10	5	2	3.5	11.5	100'
600	12	3	4	4.2	9	80'

*There are two options with the 480 gpd flow rate: 2 laterals with 5 coils per lateral or 5 laterals with 2 coils. Coils must be arranged in a single line.

Basal Area:

The basal area is comprised of the total area where the sand media is in contact with the receiving soil. The minimum required basal area is calculated by dividing the design flow rate by the soil loading rate specified in WAC 246-272A.

Example, Soil type 4

480 gpd ÷ 0.6 gpd/ft2 = 800 sq. ft.

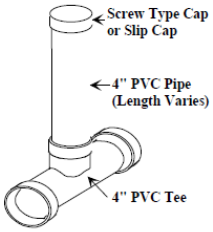
Combining Hydraulic and Basal Area Requirements:

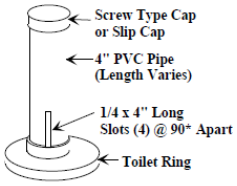
On flat sites (0-5% slope), the coils will be placed as evenly as possible in the center of the basal area. The coils will be arranged in a single line with a minimum separation between coils of 6". Also, no emitter shall be placed within 6" of the sand media shoulder.

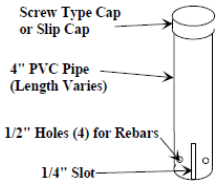
On sloping sites (>5 to 20% slope) the coils will be placed in a single line, parallel to the contour and one edge of the coils must be placed within 12" of the upslope basal boundary. There must be at least 6" separation between sand shoulder and an emitter and between any two emitters of different coils. If the slope of the original contour is greater than 20% then the basal area can be modified to achieve a slope of 20% or less. In this case, vertical separation is measured between the restrictive layer to the final grade or level of the basal area. The maximum slope of the basal area is 20%.

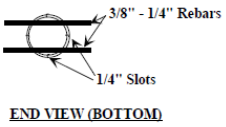
To combine the coil layout and the basal area, start with the coil layout. Coils are placed in a line on contour with 6" separation between coils (coil length). The shoulder of the sand media must extend at least 6" beyond the coils. Side slopes of the

sand media is at least a 1 to 1 slope. The minimum length of the basal area equals the number of coils with the 6” separation between coils plus a 6” separation between the coils and shoulder plus the side slopes. Two inspection ports must be installed: one in the coil area and the other in the basal area as shown. See illustration below.

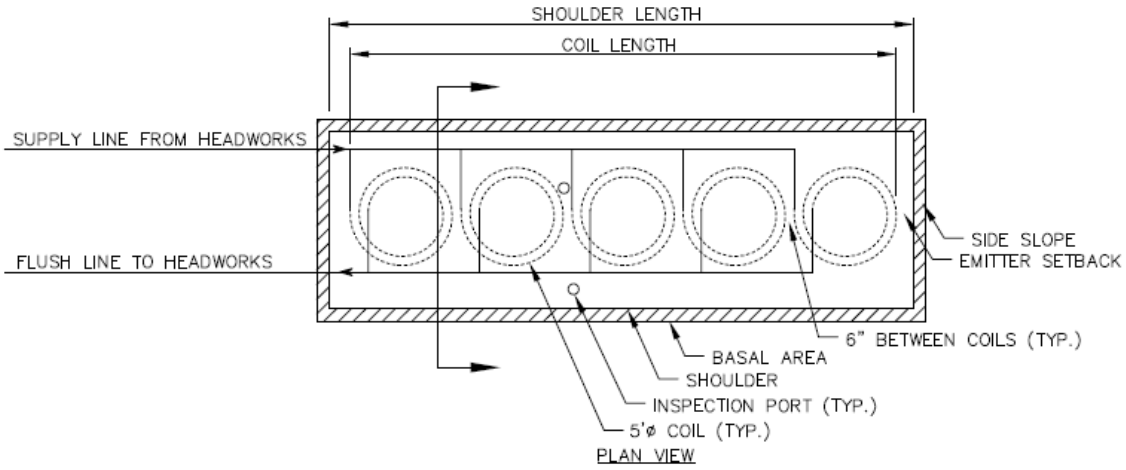


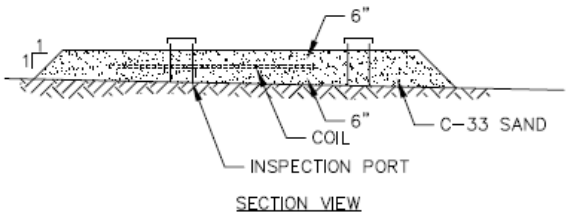






FLAT SITE





Example: (refer to illustration above)

240 gpd design flow, soil type 4 (0.6 gpd/ft2), flat site

Basal area required = daily design flow ÷ soil loading rate

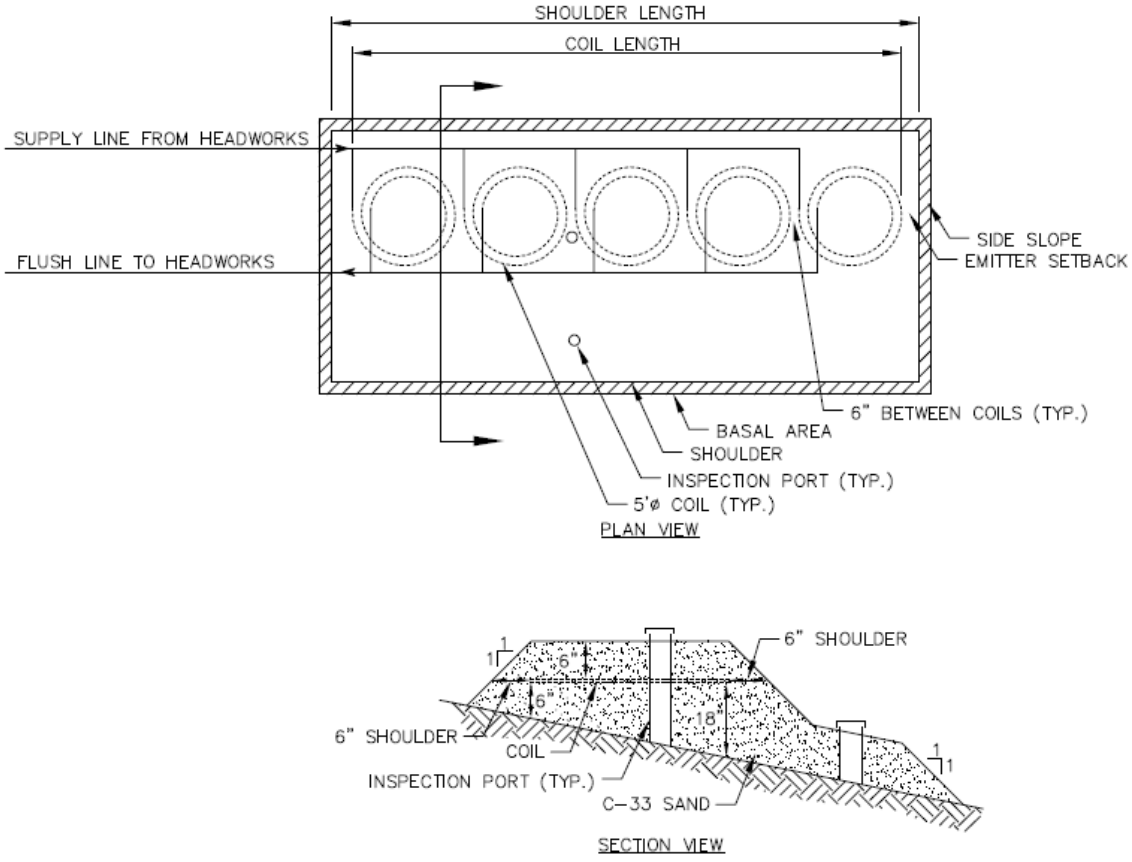
240 gpd ÷ 0.6 gpd/ft2 = 400 sq. ft.

Coil length = 5 coils @ 5’ diameter (5 x 5’ = 25’) with 6” coil spacing 4 x 6” = 2’ = 27’
Minimum shoulder width @ 6” (2 x 6” = 1’) = 1’
Minimum side slopes at 1 : 1 slope @ 6” (2 x 6” = 1’) = 1’

Minimum basal area length = coil length + shoulder widths + side slopes
= 27’ + 1’ + 1’ = 29’
Basal area width = required basal area ÷ minimum basal length
= 400 sq. ft. ÷ 29’ = 13.79 or 14’

Basal area dimensions = 29’ x 14’

SLOPING SITE



When calculating the required basal area for a sloping site the same process is used as a flat site except for one criterion. The side slope value must include the increased sand depth due to the sloping site. In order to keep the coils level on a sloping site, additional sand must be placed under the downslope side of the coil. To calculate the additional sand needed use the following formula:

Diameter of coil x % slope of site

In the illustration above the 20% slope needs an additional 12" of sand to maintain a level coil network.

60" x 20% = 12"

The additional 12" of sand needs to be added to the minimum required sand of 6" to equate to the 18" of sand on the downslope side of the coil.

Example: (refer to illustration above, not to scale)

240 gpd design flow, soil type 4 (0.6 gpd/ft2), sloping site

Basal area required = daily design flow ÷ soil loading rate

240 gpd ÷ 0.6 gpd/ft2 = 400 sq. ft.

Coil length = 5 coils @ 5' diameter (5 x 5' = 25') with 6" coil spacing (4 x 6" = 2') = 27'
Minimum shoulder width @ 6" (6" x 2) = 1'
Minimum side slopes at 1 : 1 slope @ 18" (18" x 2) = 3'

Minimum basal area length = coil length + shoulder widths + side slopes
= 27' + 1' + 3' = 31'
Basal area width = required basal area ÷ minimum basal length
= 400 sq. ft. ÷ 31' = 12.9' or 13'

Minimum basal area dimensions = 31' x 13'

Timer Settings:

Timer settings for the *OSCAR* are set at the factory and are short and very frequent. It is expected that the supply line will stay charged between doses. It is therefore strongly recommended to site the OSCAR coils at or above the discharge tank elevation (pump up to the OSCARs) and install a check valve on the discharge pump.

There are two reasons for changing the timer settings:

1. The *OSCAR* is installed down slope from the discharge tank. The timer settings may need to be modified to avoid over dosing the *OSCAR* and a vacuum breaker must be installed on the supply line inside the pump chamber to prevent siphoning. Pump down hill to the *OSCAR* should be the last option and is not recommended. Call *Lowridge* for assistance in changing timer settings.
2. In colder climates where the supply line needs to drain between doses, the "on time" will need to be increased to compensate for filling the supply line prior to each dose. Call *Lowridge* for assistance in changing timer settings.

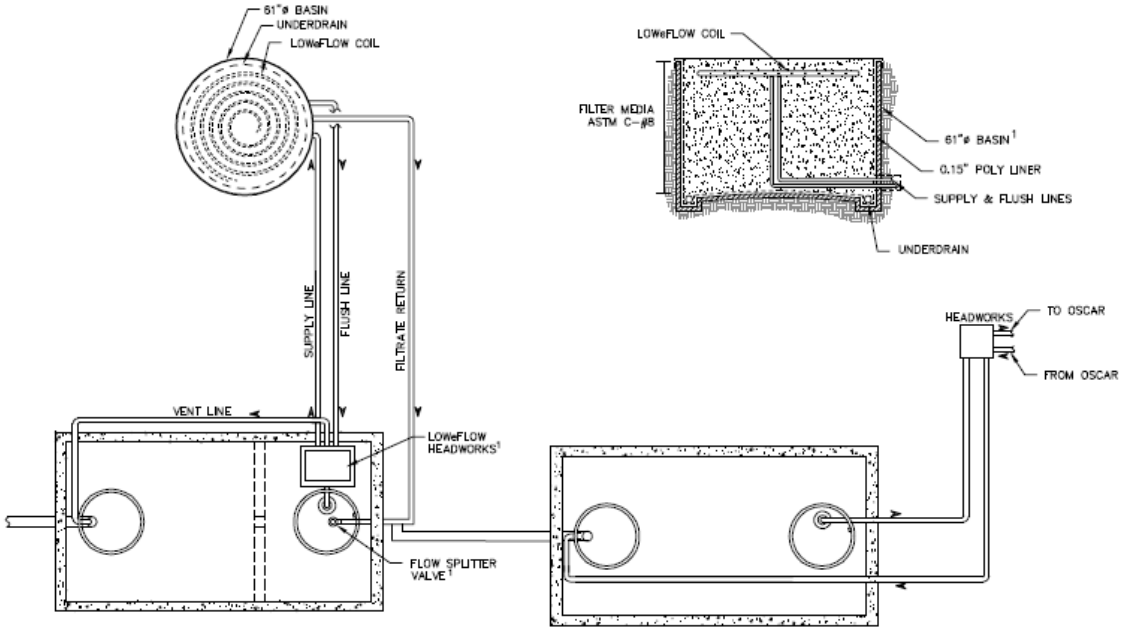
Set-backs:

	When the item to be setback from is:	
	Upgradient[1]	Downgradient[2, 3]
Setback distance from **property lines**, **driveways**, **buildings**, **ditches** or **interceptor drains**, or any other development which would either impede water movement away from the mound or channel groundwater to the mound area.	10 feet	30 feet
Setback distance from **well**, **suction line** or **surface water**.	100 feet	100 feet

[1]The item is upgradient when liquid will flow away from it upon encountering a water table or restrictive layer.
[2]The item is downgradient when liquid will flow toward it upon encountering a water table or restrictive layer.
[3]The edge of required basal area.

All other set backs are according to local code or WAC 246-272A.

***OSCAR-LOWeFLOW™* Treatment Unit**



1500 gallon two compartment settling/recirc tank 1000 gallon single compartment clarifier/discharge

The *LOWeFLOW™* treatment unit is comprised of the *LOWeFLOW™* recirculation filter, a septic tank, recirculation tank, discharge/clarification tank, headworks, and control equipment.

Wastewater is collected in a standard septic tank where gross solids are settled out and primary treatment occurs. Septic tank effluent flows from the septic tank into the recirculation tank. Liquid in the recirculation tank is mixed with treated filtrate from the *LOWeFLOW™* filter. The mixed liquid is dosed to a drip tubing network called a *Coil* in the top of the *LOWeFLOW* ™ filter. Treated filtrate from the *LOWeFLOW™* filter flows back to the recirculation tank through the split flow tee. The position of the splitter valve determines the flow path of the filtrate. When the liquid level in the recirculation tank is high enough to seat the splitter valve, all of the filtrate passes to the discharge/clarification tank, otherwise, all or a portion of the returning filtrate returns to the recirculation tank.

Effluent from the discharge tank is timed dosed to the *OSCAR* coils for final dispersal.

Design Criteria

There are four segments to the *LOWeFLOW™* Treatment unit design: filter sizing, number of *Coils*, tanks, and pump/control equipment. The standard residential *LOWeFLOW™* unit (***LF-500***) is a 500 gpd kit with some field assembly required (for parts list see appendix C). For system design greater than 500 gpd design flows see appendix "B".

Filter sizing:

A standard residential 500 gpd unit is sized based on 25 gpd/sq. ft. or 20 sq. ft. The media for the *LOWeFLOW™* filter shall be pea gravel meeting ASTM C-33, size #8 (see Appendix A). The depth of the media required between the tubing and underdrain is 30". There is an additional 3" of media covering the drip tube and 3" deep layer of media for the underdrain. The over-all height of the *LOWeFLOW™* filter is 36". Child proofing mesh must be placed over the coils prior to final cover media installation.

Drip Tubing Network Layout:

The tubing used in the *LOWeFLOW™* Treatment unit is exclusively Netafim Bioline™, 0.42 gph emitters. Each residential *LOWeFLOW™* unit is equipped with four (4) 100 foot laterals configured in a pre-assembled *Coil*. The *LOWeFLOW™* unit is intended to be operated at a 4:1 recirculation ratio. See appendix D for details on timer settings.

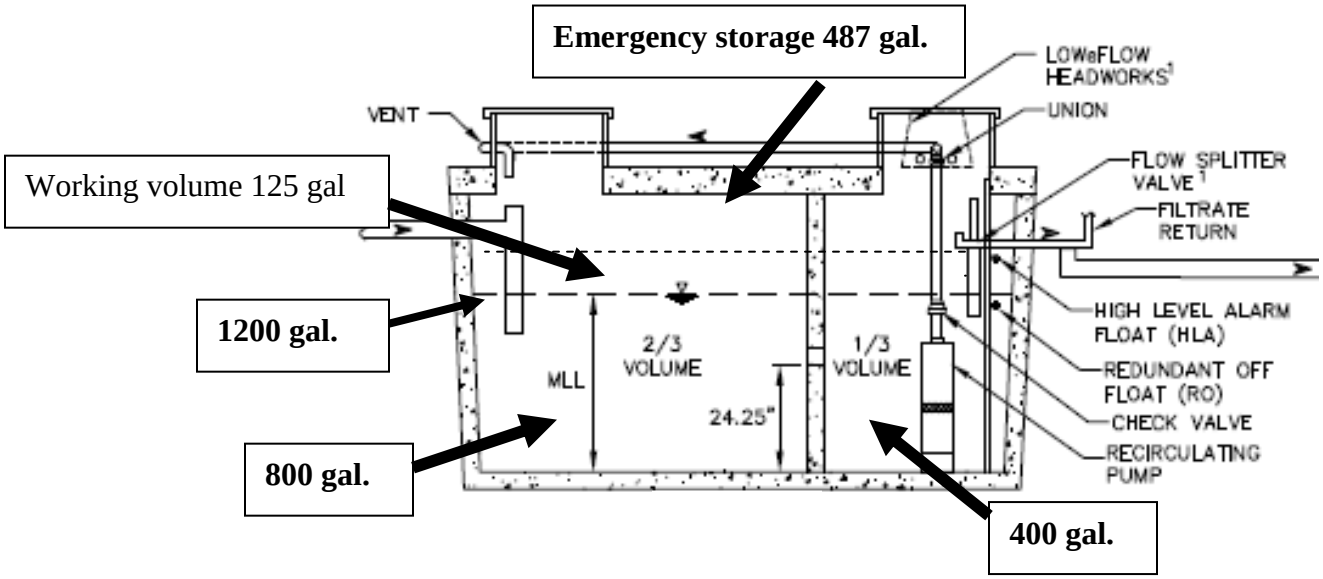
Tanks:

All tanks must be approved by WA DOH as wastewater containment vessels. Minimum liquid volumes for a 500 gpd design flow are:

- Settling (septic) tank **800 gallons**
- Recirculation tank **400 gallons**
- Clarification volume **250 gallon**

There are two options for septic/recirculation tank arrangements: a double compartment tank with a flow through port between compartments or two tanks, a single compartment septic tank and a separate recirculation tank.

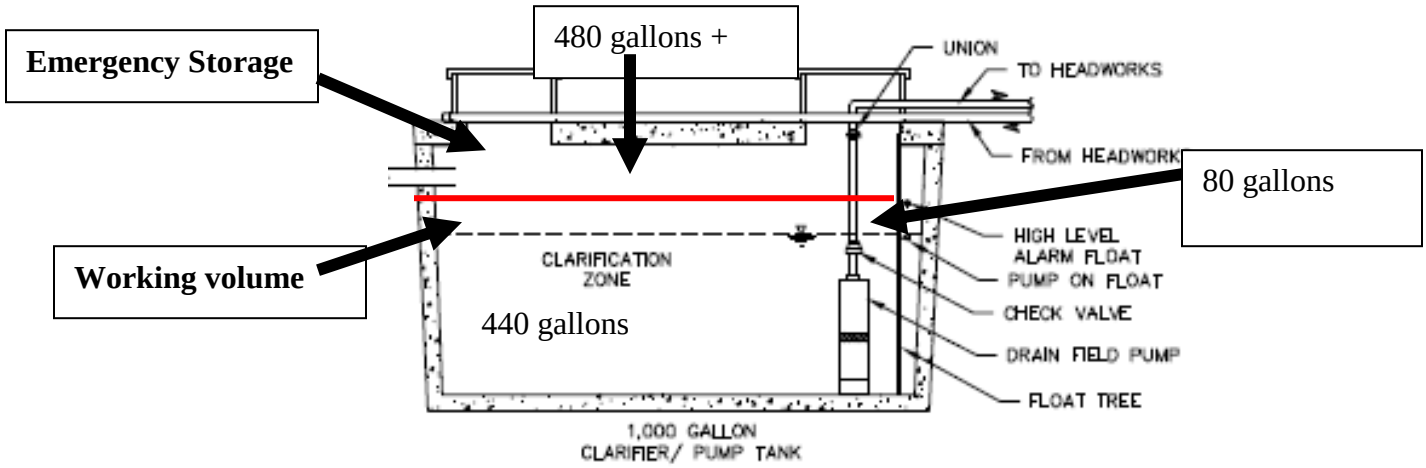
Single tank:



A 1500 gal two-compartment tank with a 2/3 first compartment and 1/3 second compartment volume split and a 4" diameter flow through port 24-29" above the floor. The first compartment serves as the primary settling (septic) tank and the second compartment is the recirculation tank.

Clarifier: The *OSCAR-LOWeFLOW™* system must incorporate at least 250 gallons of clarifying capacity for a 500 gpd design flow. Clarification capacity is the minimum liquid in the discharge tank to submerge the discharge pump. The discharge pump is 22" tall. A standard 1,000 gallon pump tank (minimum requirement) has a volume of 20 g/inch. (Check with the tank manufacturer for exact figures). When the pump is submerged, there are 440 gallons of dead volume in the tank. This volume is in excess of the 250 gallons needed for the clarification volume. The working volume depth is 4" or 80 gallons.

Emergency storage for the clarification/pump chamber is achieved in the recirculation tank through the control panel. A high level alarm in the clarification/ pump chamber will override off the recirculation pump. When a high level condition occurs in the clarifier/discharge tank the recirculation pump is overridden off and no flow will progress from the recirc tank to the clarifier/discharge tank until the high level condition in the clarifier/discharge tank is correct.



Pumps/Control Equipment

The *OSCAR-LOWeFLOW™* Treatment system incorporates a recirculating pump which has two functions: dose the *LOWeFLOW™* filter and flush the *Coil* and disc filter.

The *OSCAR* will need a 19 gpm ½ hp turbine pump. The standard control panel used in most residential application is the ***LF2P-RF-OS*** which will accommodate the recirculation/flush pump, a discharge pump, and the *LOWeFLOW™* headworks. A high level alarm in the discharge tank overrides off the recirculation pump. Emergency storage for pump failure is only needed in the settling/recirculation tank.

Appendix A

Media:

LOWeFLOW

ASTM C-33, #8, nominal size 9.5mm to 2.36mm

Size	12.5mm	9.5mm	4.75mm	2.36mm	1.18mm
%passing	100	85-100	10-30	0-10	0-5

OSCAR

ASTM C-33 sand media: as per Washington Department of Health's Recommended Standards and Guidance for Intermittent Sand Filters.

Appendix B: Design flow greater than 500 gpd.

Design flow of 600 gpd: The 600 gpd system is upsized 20% from the 500 gpd unit. A six hundred (600) gpd unit must incorporate a pressure treated wood box and a 30 ml PVC liner as the filter basin (both included in the *LF-600* kit). The containment box dimensions are 5.5'x 5.5' and 3' deep.

Design parameters:

Tanks, minimum liquid volumes:	
Settling tank	960 gallons
Recirc. Tank	480 gallons
Clarifier capacity	300 gallons
Filter basin:	30.25 sq. ft.
Coil	600 gpd *Coil*
Child proofing mesh	

Design flows of >600 to 1000 gpd:

Tanks, minimum liquid volumes:	
Settling tank	200% of design flow
Recirc. Tank	80% of design flow
Clarifier	50% of design flow
Filter basin:	
Coils	2- *Coils*
Basin	6' x 12'
Child proofing mesh	

For flows over 1,000 gpd additional *LOWeFLOW™ Coils* can be added in increments of 500 gpd. For each *Coil* specify a 6'x 6' area of media surface to allow for manifolds and plumbing connections or a series of 500 gpd poly basins each containing a 500 gpd coil. Call *Lowridge Onsite Technologies* for assistance.

Appendix C: Parts list for standard residential, 500 gpd kit:

- *LOWeFLOW*™ basin & *Coil* (child proofing mesh)
- Headworks: disc filter, solenoid valves, pressure gauges
- Splitter valve
- Splitter tee
- Recirculation pump: 1/2 hp, 19 gpm turbine pump
- *LF2P-RF-OS* Control panel
- Floats for recirculation and discharge pumps
- Headworks for *OSCAR* coils
- *OSCAR* coils necessary for design flow
- *OSCAR* pump: ½ hp, 19 gpm turbine pump

Appendix D: Timer Settings for Recirculation Pump

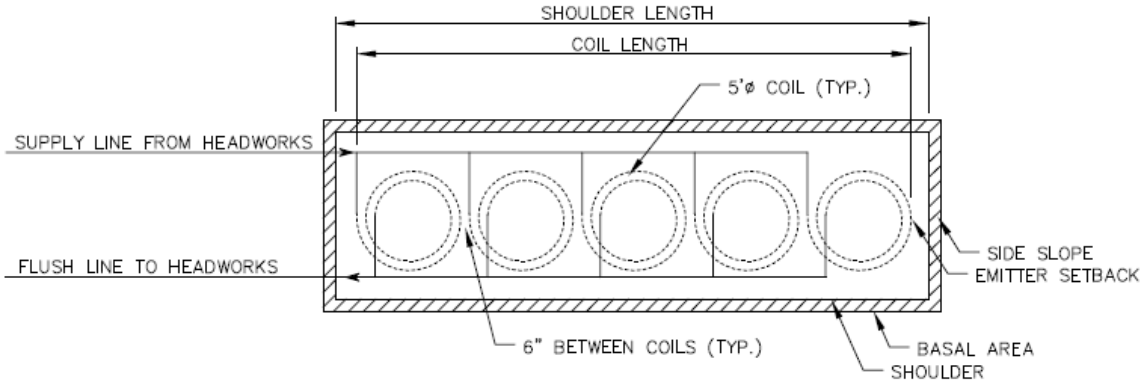
The goal is to achieve a recirculation ratio of 4:1 of the average daily flow. The table below gives the timer settings for a variety of average daily flows. Note that the "ON" time is always **30 seconds**. The standard 500 gpd *Coil* has an estimated flow rate of 5.5 gpm. Actual flow may vary.

Ave. Daily Flow	**Recirc. Flow rate**	**"ON" Time**	**"OFF" Time**
100 gpd	400 gpd	30 seconds	9.5 min
150	600	"	6.0
200	800	"	4.5
250*	1000	"	3.5
300	1200	"	3.0
350	1400	"	2.5
400	1600	"	2.0
500	2000	30 seconds	1.5 min

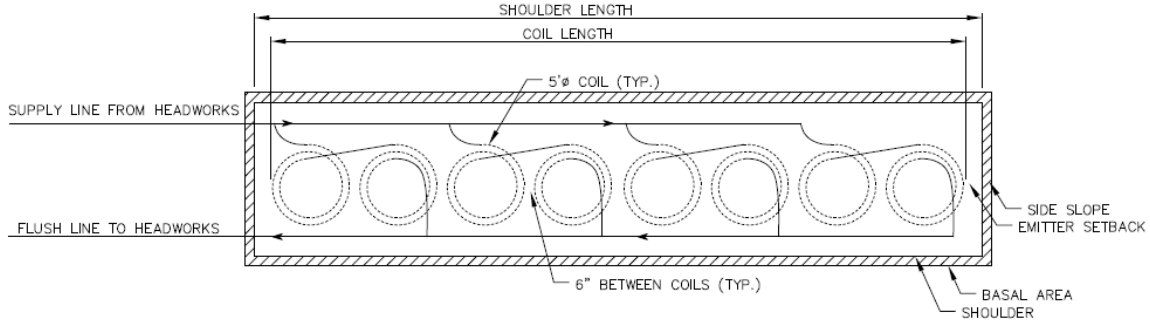
*Factory default setting.

Appendix E:
Sample Design layouts

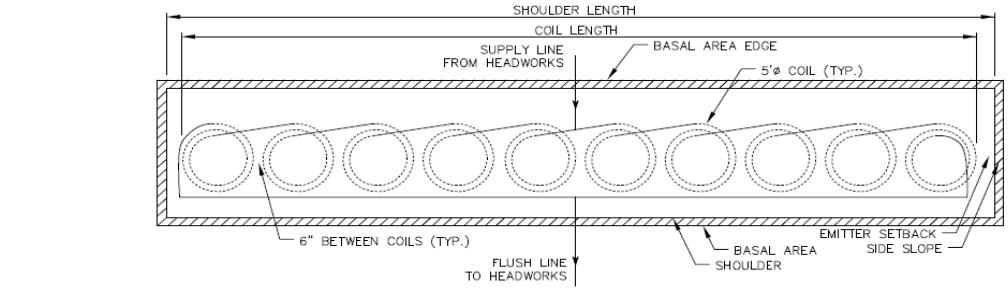
240 gpd design flow:



360 gpd design flow:



480 gpd design flow:



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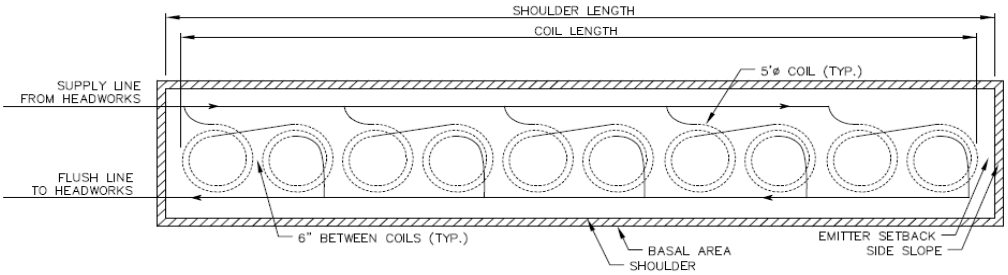
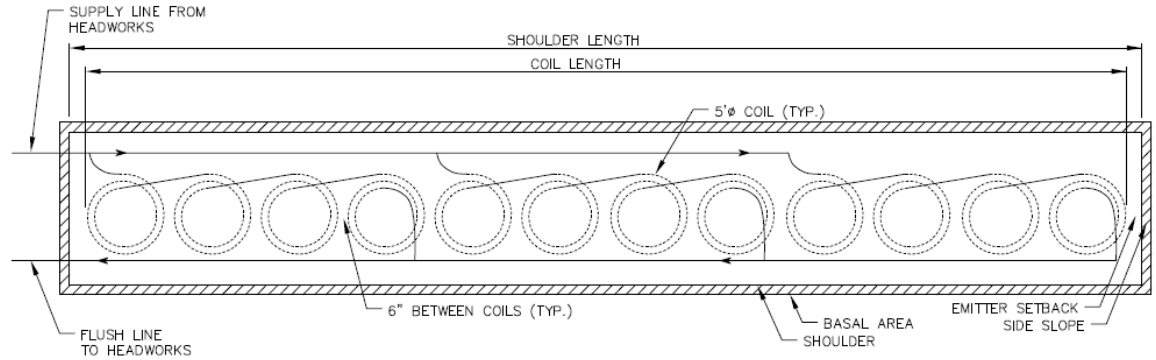


600 gpd design flow:



Appendix F:
Headworks: LOT-HWN-.7

- ¾" Arkal disc filter, mesh, 130 micron
- ¾" Arad flow meter
- Three oil filled pressure gauges
- One ball valve

Appendix G:
OSCAR Parts list

Each OSCAR unit will include:

- OS-50 Coils (whatever quantity is necessary for the design flow)
- PVC fittings and drip tubing adapters
- LOT-HWN-.7 manual headworks
- Solid ½" poly tubing for connections
- ½ hp, 110 volt, 19 gpm turbine pump

Appendix H:
***OSCAR* coil Connections**

Manifolds and supply lines are 1" Sch 40 PVC

Manifold and blank tech line adapter and connection.

Blank tech liner and Bioline connection with internal coupling